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UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

OAK RIDGE OPERATIONS
P. O. BOX E
OAK RIDGE, TENNESSEE 37830

AREA CODE 615
TELEPHONE 483-8611

July 18, 1977

C. A. Keller, Assistant Manager
for Operations

INTERIM STATUS - Hg

1. A few hundred fish were collected from Poplar Creek and the Clinch River this Spring and specimens are being analyzed -- data expected within a month or so.

2. TVA has informally agreed to our proposal to include the Poplar Creek area in their ongoing Hg study and have requested ORNL be omitted. Formal confirmation (Krinkel to Hart) is expected shortly. They requested sediment data and this was provided.

3. Preliminary revised analyses of New Hope Pond effluent indicate very low levels of Hg are present. Y-12 is presently investigating the several influent sources. Even if found, none are expected to be significant.

4. The Y-12 Hg inventory which has been completed and reviewed, concludes no further excavation is warranted. Pending the results of the activity described in 3. above, we agree. A copy of the inventory is attached.

5. ORGDP is preparing an EIS and Y-12 is preparing an EIA -- both at HQ request. We believe the Hg-in-fish and sediment problem should be included only in Y-12's EIA.

H. D. Hickman 7-18-77
H. D. Hickman, Director
Manufacturing Division

T 7-15-77
W. H. Travis, Director
Safety & Environmental Control Division

OSE:JFW
Enclosure:
Y-AD-428, Copy 3A, ORO-183271, (w/4 pg. Conf. attachment)

3472.10

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UNION CARBIDE CORPORATION
NUCLEAR DIVISION
P. O. BOX Y, OAK RIDGE, TENNESSEE 37830

June 9, 1977

United States Energy Research and Development
Administration, Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37830

8724

Attention: Mr. H. D. Hickman

Gentlemen:

UNCLASSIFIED VERSION OF
Mercury Inventory at Y-12 Plant 1950 through 1977

Attached is the information you requested regarding mercury releases in the Y-12 area. Also attached is additional information to support this mercury review.

Please let us know if further information is desired.

Very truly yours,

for J. M. Case, Plant Manager
Oak Ridge Y-12 Plant

DWS:jal

Attachments: "Solvent Losses through Ventilation Exhaust Systems, Bldg. 9201-5" (C)
"Estimated Mercury Losses in Creek Waters 1955 through 1975" (OUO)

Distribution, Series A:
Copies 1-5: H. D. Hickman
6: D. J. Bostock(Y-12RC)
7: J. M. Case
8: R. F. Hibbs
9: R. G. Jordan
10: J. D. McLendon
11: C. J. Parks
12: R. D. Williams

Distribution, Series C:

H. D. Hickman, DOE-ORO

5472.10

SUMMARY

The Y-12 Plant was involved with the handling of production quantities of mercury from 1950 through 1963. The maximum inventory in the Plant was during 1956-1957 Deleted 2.4 million pounds has either been lost or is material unaccounted for.

Known losses are:

1. Airborne losses
2. Creek losses
3. Recorded spills
4. Deliberate overage in bottling of Y-12 mercury for GSA

Material unaccounted for:

1. Salvage still in 9201-4
2. Anticipated overage in 9201-4 inventory
3. Mercury carried out on equipment during 9201-5 stripping operations
4. Mercury retained in the extract or "tails" material during lithium processing
5. Probable shortage of mercury in the original inventory when the system was charged by Rust Engineering Company

The majority of the mercury which was released to the environment occurred during early operations of the Colex Process, 1955 through 1958. This material was discharged either to the air, lost to the creek (approximately 230,000 pounds), or lost in the earth.

The airborne losses were reduced to practically zero in 1958. The creek losses have been less than the minimum detectable limit since 1963. There have not been any earth losses reported since operations were terminated in 1966.

Current practices and procedures for the bottling of the existing inventory minimize the possibility of any creek or earth losses. Air losses continue to be minimal. Processes are being developed to prevent the loss of any mercury when the remaining process equipment is washed and stripped from Building 9201-4.

CONCLUSIONS

1. Based on the past ten years data, it appears in the future the creek losses will not exceed the drinking standard for water.

2. In comparing loss data at the source (9201-4 and 9201-5) and the creek data leaving Y-12 with the approximate or actual date of known losses to the earth, there is no evidence that these ground losses had or have reached Poplar Creek.

3. Based on the water quality leaving Y-12 in the past 14 years by effluent sampling, it is concluded that losses to the earth are contained in the shale beneath the spill locations.

4. If the soil from the creek were excavated in a strip 20 ft. wide, 20 miles long, and to a depth of 12 inches, it would totally destroy the creek and would remove less than 4,000 pounds of mercury.

5. After inspection of all identified spill locations, it is felt that no further excavation is warranted.

RECOMMENDATIONS

1. It is recommended that monitoring for total soluble mercury in the east fork of Poplar Creek be continued.

2. Limited data on soil samples are available from the east fork of Poplar Creek. It is recommended that soil samples be taken on an annual basis to determine the rate in which the soil in the creek is being purged of mercury.

3. It is recommended that soil samples be taken in future major excavations of areas that had large quantities of mercury used and/or lost. This would determine if salvage operations are warranted.

4. A survey was made of mercury processing areas, known mercury spill locations, and the mercury storage area with the following recommendations being made:

   a. 81-10 - Visible mercury should be cleaned up and the mercury trap and settling basin cleaned.

   b. 9201-5 - One small area contaminated with mercury was found. This will be cleaned up.

   c. Increase clean-up activities in the Feed Prep./Extraction and the Evaporator areas. Drain equipment and pipe lines in the same manner that the cascade equipment is being emptied. This will leave the entire building in a "drip free" condition until final stripping is initiated.

d. Mercury storage (Building 9720-26) - No changes are recommended.

e. 9201-2 - The basement area of this building was examined in those areas where known spills and excavation had taken place. No visible mercury was seen.

INVENTORY BALANCE

Total mercury received in Y-12	
Bottled prior to 1977	Deleted
Estimate of overage when filling bottles[1]	
Estimate of material removed in 9201-5 stripping[2]	
Recovered by Mallory Battery Company	
Estimate from decommission of facility	
Mercury in extract produced[3]	
Book Inventory 9201-4 December 31, 1976	
Estimated inventory error[4]	
Estimated hold up in 9201-4 salvage[5]	
Estimated hold up in 9201-4 equipment[6]	
Total estimated 9201-4 inventory	
Measured loss 9201-5 March, 1966	49,853
Creek losses through 1972[7] (soluble)	235,000
Creek losses through 1964[8] (entrained, estimated)	235,000
Mercury in sludge removed from New Hope Pond[9]	7,200
Airborne losses 1955 through 1963[10]	30,000
Total mercury accounted for	Deleted
Total mercury unaccounted for	1,880,699

[1] Y-12 bottling procedure calls for filling bottles to 76 pounds -0+2 ounces

[2] All equipment removed from 9201-5 had some mercury contamination

Deleted

[7] Creek losses 1955 to present

[8] No analysis available on entrained material. Estimated to be equal to soluble mercury

[9] Average analysis of sludge removed from New Hope Pond

[10] Letter J. C. Little to distribution dated March 4, 1956

HISTORY

1. Development and Pilot Facilities

a. Building 9733-2 - Development facility for the Elex Process (Electrical Exchange). Operated 1950 and 1951.

Mercury inventory [Deleted]

Effluent control - This facility had a steel sump or trap installed in the floor drain system before entering the storm sewer. This trap was routinely checked and emptied. This system was incorporated on all of the future development and pilot facilities. Except in the event of gross spills, it proved effective in preventing metallic mercury from entering the creek.

Losses - There were no major losses reported.

b. Building 9733-1 - Development facility for the Orex (Organic Exchange). Operated 1951 and 1952.

Mercury inventory - [Deleted]

Effluent control - Same as 9733-2.

Losses - There were no major losses reported.

c. Building 9201-2 - Pilot plant for the Elex Process and for the Colex (Column Exchange) Process. Operated September, 1951 through 1955.

Mercury inventory - [Deleted]

This building housed several pilot plants and equipment test facilities over the four-year period and was Y-12's first involvement with significant quantities of mercury. During the operation of the different facilities there was a total loss of 108,000 pounds. Major recovery operations were conducted by excavation of dirt from the basement of this building. Visible mercury was collected from the dirt. The rest of the dirt was stored and later processed through the Nichols Hershoff furnace at Building 81-10. At one time recovery attempts were made by manually digging at the storm sewer discharge to the creek. (N. K. Bernander). There was very little mercury recovered in this attempt.

Although there was a large amount of material unaccountable as a result of operations, there is no record of any one large spill that was lost to the environment.

d. Building 9202 - Pilot plant for the Orex Process. Building operated April, 1953 through May, 1954.

Mercury inventory - [Deleted]

Operations in this building were of the same magnitude as the 9201-2 facilities. Estimated losses were 50,000 pounds. There were no major spills recorded; however, when a mercury inventory showed a significant loss and it had not been recovered in the trap outside the building, the storm sewer between the building and the trap was excavated and an attempt to recover the mercury was made. The dirt from the recovery operation was stored for later processing in the Nichols Hershoff furnace. (A. D. Ryan).

2. Production Plants

a. 9204-4 Elex Production Plant operated 1953 through Spring, 1956.

Mercury inventory [Deleted] At the end of the program, the inventory showed a loss of 71,000 pounds. The design of this operation reduced the probability of major spills. The majority of the process equipment was on the upper levels of the building and spills could be cleaned up before getting to the outside. There were occasional spills in the salvage recovery area in the basement, some of which could have been lost to the storm drain or to the earth through cracks in the floor.

b. 9201-5 Colex Production Plant. Operated January, 1955 through February, 1959, and partial operations were resumed for a Lithium-7 production run in December, 1962 through May, 1963. The building was stripped of process equipment in 1965 and 1966.

Original design provided [Deleted] settling tanks to collect process overflows to prevent loss of mercury to the creek. The system was soon modified to also catch all of the building floor drains. All building effluent was pumped to a neutralizing sump south of the building where it was periodically pumped to the storm sewer. Development studies resulted in minimizing the flow to this sump and using it as a settling basin with a continuously monitored overflow.

During the initial building startup, there were numerous mercury and amalgam spills in the building. Although the volume of the spills was not recorded, recovery operations were considered to be effective but it must be assumed that mercury was lost both to the ground and to the storm sewer system.

There were three known spills of mercury on the ground outside of 9201-5 and two major spills inside the building during this period where mercury is known to have been discharged to the environment. These will be discussed in detail later.

c. 9201-4 Colex Production Plant. Operated June, 1955 through December, 1962. The design of this building was similar to that of 9201-5. Process and waste treatment improvement paralleled those in 9201-5. The major auxiliary operations (Feed Prep., Extract, and Evaporation) for both buildings were conducted at 9201-4.

There were no reported major spills to the environment at this building. Process spills and leaks were similar in nature and magnitude as those in 9201-5.

d. Building 81-10 - This facility was constructed in 1956 and 1957. Operations were intermittently from March, 1957 through May, 1962. This facility was designed to recover mercury from solid wastes by evaporation and condensation. The primary feedstocks for the facility were filter solids (both lithium carbonate and powdered graphite), decomposer graphite, floor sweepings, "sludge" (solids recovered from settling tanks), and contaminated dirt (from excavating outside or around spills). Deleted The facility was constructed on a concrete pad with the drains being collected in a concrete mercury trap. All of the effluent from this facility flowed through the trap to a settling basin before being discharged to the creek.

Losses to the surrounding area were experienced through cracks in the concrete, water leaving the facility, and airborne losses.

3. Spills

There were five major spills during the Y-12 operations where mercury was released to the environment. These are in addition to the losses reported for 9201-2 and 9202.

a. Summer, 1955

200-400 gallons (22,500 - 45,000 pounds).

Northeast corner, 9201-5.

Condition - Plugged decomposer, Deleted

Recovery - Visible mercury shoveled off of ground (earth). Backhoes brought in to excavate. Drums of salvage dirt later processed at 81-10. (T. W. Robinson, G. W. Evans).

b. December 31, 1955

1,000 - 1,500 gallons (113,000 - 170,000 pounds).

South end of Crane Bay 6 (inside) 9201-5.

Condition - Ruptured expansion joint Deleted Mercury sprayed through south end of building.

Recovery - All visible mercury recovered inside building. Some mercury released through basement of fan room floor.

c. Summer, 1956

200-800 gallons (22,500 - 90,000 pounds).

Lost on ground at mercury dumping station.

Condition - Improper valving while transferring mercury from 9204-4 to 9201-4 and 9201-5.

Recovery - Visible mercury recovered by manually shoveling up surface dirt. Excavation by backhoes. The dirt excavated was stored in drums and later fed to Nichols Hershoff furnace at 81-10. (J. E. Smyrl).

d. Summer, 1956

200-800 gallons (22,500 - 90,000 pounds).

Lost on ground north of First Street at ramp entering 9201-5.

Condition - Improper valving while transferring mercury from 9201-5 to 9201-4.

Recovery - Visible mercury recovered by manually shoveling and vacuuming. Excavation by backhoes with dirt drummed and later fed to 81-10. (J. E. McNabb, W. H. Hubbs, D. W. Smith).

e. March, 1966

890 gallons (100,000 pounds).

9201-5 Fan Rooms E and F.

Condition - Leaky "sight glass" on storage tanks.

Recovery - Visible mercury recovered by vacuuming and sweeping

Deleted

Core drilled in basement to locate remaining mercury. No significant quantity was located.

X This spill documented in United States Atomic Energy Commission report of investigating committee, "Loss of Mercury at the Y-12 Plant," dated 1966.

4. Losses

a. Airborne losses - During operations, a maximum of 30,000 pounds have been lost as airborne losses. (Letter J. C. Little to distribution dated March 4, 1956). Calculated quantity is based on Alpha-5 operations of 400 days at 20 pounds/day and 1100 days at 5 pounds/day; Alpha-4 operations of 250 days at 20 pounds/day and 2200 days at 5 pounds/day.

b. Creek losses - Creek losses of mercury totaled 470,000 pounds through 1962, with an additional 5,000 pounds being lost through 1972. Since 1972, losses have been less than 18 pounds/year. (Letter J. M. Napier to O. W. Smith dated March 5, 1977).

c. Spills - An estimate of losses to the earth is difficult to establish; however, from the inventory balance this loss could be as much as 1,880,699 pounds. The sum of unrecovered mercury from the five spills is estimated between 150,000 and 225,000 pounds.

INVENTORY SHORTAGE

During the charging of the Colex System (9201-4 and 9201-5) in 1955, Rust Engineering Company emptied [Deleted] flasks of mercury. This operation was done over a period of 6 to 8 months. Although the receiving vouchers showed the quantity of flasks received to be correct, there was some comment made at that time (undocumented) that some of the flasks were only partially full or empty at the time they were emptied.

It is felt that there was an initial inventory shortage at the time the system was filled; however, no finite number is being assigned for this shortage. The following evidence is offered to support this conclusion.

1. As early as 1958 when the first mercury was being flasked and returned to GSA leaky flasks were found. These flasks were discarded.

2. During storage, it was found that some of the accepted flasks (20-25 psi pressure test) were "leakers" and these were removed from Y-12 storage upon detection.

3. These flasks were the same ones that the mercury was received in and had been in storage throughout the world for an undetermined period.